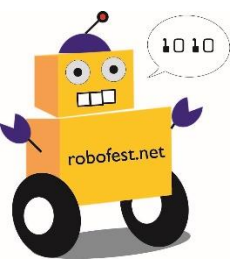


WISER

Comparing skills needed to compete
in Robofest vs those needed for a
career in Industrial Robotics



David A. Carbery P.E.

ROBOFEST
LAWRENCE TECHNOLOGICAL UNIVERSITY

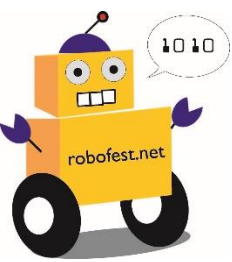
- BSEE LTU 1989
- Michigan PE License 1999
- BSA Scoutmaster, Troop 248 since 2007
- Robofest volunteer/coach since 2011
- FANUC America Corporation since 1989

Staff Engineer, Product Development

Agency approvals

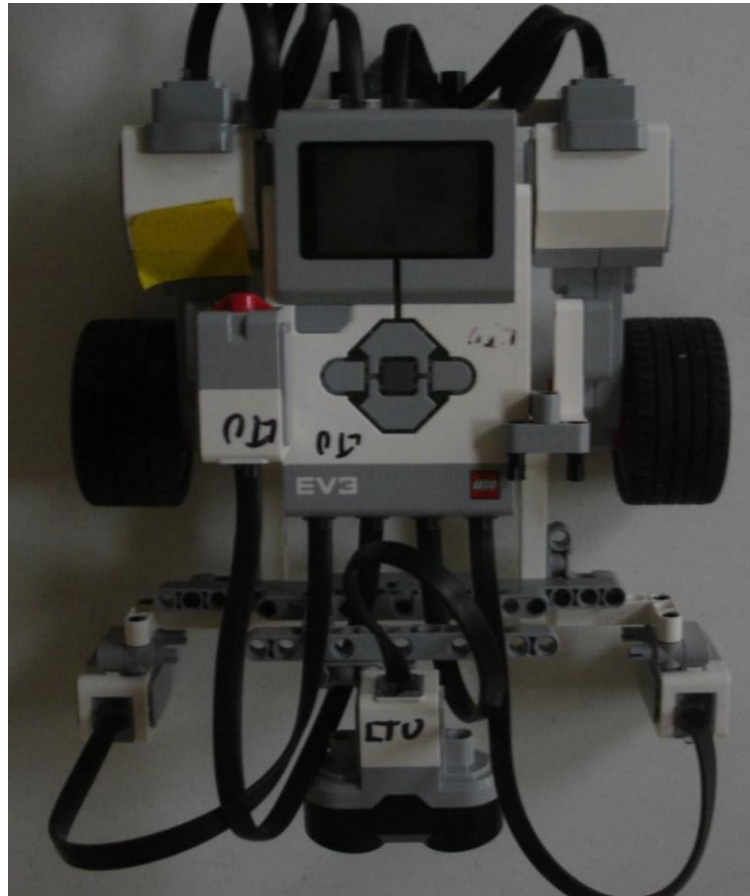
IS components

High Voltage systems



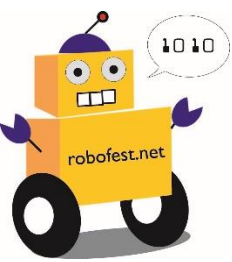
Comparing Robots

Mindstorms EV3 Robot



FANUC P-250iB Robot





Comparing Motors

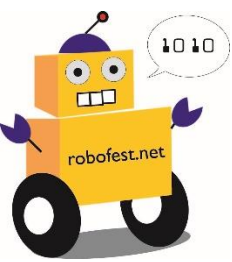
Mindstorms EV3 motors

- Optical encoder: 360 cnt/rev
- 170 RPM
- 1/100 HP

FANUC motors

- Optical encoder: 10,000 cnt/rev
- 10,000 RPM
- ½ to 50 HP





Comparing Sensors

Mindstorms EV3 sensors

- Color
- Ultrasonic
- Touch
- IR
- Gyro

FANUC sensors (third party)

- Limit Switch
- Proximity switch
- Pressure Switch
- Photo eye / light curtain
- Any industrial sensor

Color Sensor– can detect up to 7 colors or a lack of a color, and can detect light and its intensity



Gyro Sensor– determine the rotation and orientation of the robot on several axes

Infrared Sensor– Can detect other robots within 50– 70 cm and signals up to 2 meters away by the EV3 Infrared Beacon.

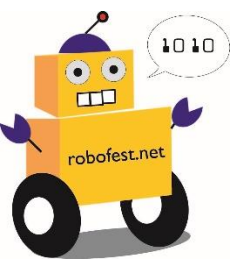


Ultrasonic Sensor– emits sound waves in order to detect the distance from an object upto 250 cm, with an accuracy of +/- 1 cm



Touch Sensor– has a button on the front, and can detect press and release actions



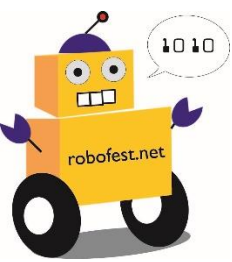


Robofest Competitions

- Game
- Exhibition
- VCC
- Bottle Sumo
- Robot Parade
- Graphical Robotics Art Festival
- Unknown Mission Challenge

FANUC Robot Applications

- Spot Welding
- Arc Welding
- Seam Sealing
- Cutting/Grinding
- Material Handling
- Painting/Coating
- Inspection
- Assembly



Software

Mindstorms EV3 Robot

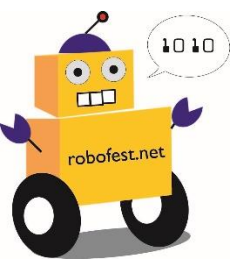
- EV3 native software
 - Block programming
- RobotC
 - Text similar to C
- MathCad
 - Advanced text & graphics
- Other 3rd party software



FANUC Robot

- Karel
 - Text similar to C
- Tool package TPP
 - Text similar to C





Teamwork

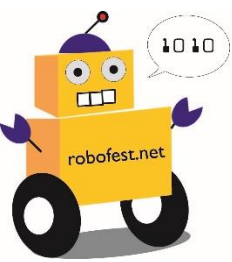
Mindstorms EV3 Robot

- Build
- Software

FANUC Robot

- Project Management
- Mechanical Engineering
- Electrical Engineering
- Software Engineering





Team Communication

Mindstorms EV3 Robot

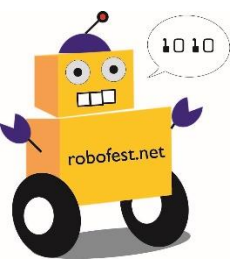
FANUC Robot

Verbal and written

- Among team members
- Between teams
- With players & coaches
- Players and judges

Verbal and written

- Among team members
- Between teams
- With suppliers
- With customers
- Reports
- Presentations
- Drawings



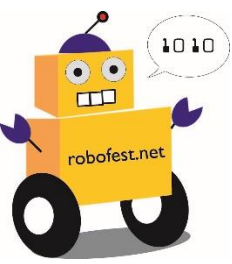
Key players

Mindstorms EV3 Robot

- Mindstorms
- VEX
- Arduino
- Raspberry Pi
- Beaglebone
- Mindsensors
- Hitechnic
- Dexter Industries
- Robot Shop
- Pololu
- Robotis
- MathWorks MATLAB
- Robomatter RobotC

FANUC Robot

- FANUC
- Yaskawa/Motoman
- ABB
- Kawasaki
- Nachi
- Denso
- Mitsubishi
- Epson
- Staubli
- Foxconn
- Comau
- Omron/Adept
- Universal



Forensic engineering example

ROBOFEST
LAWRENCE TECHNOLOGICAL UNIVERSITY

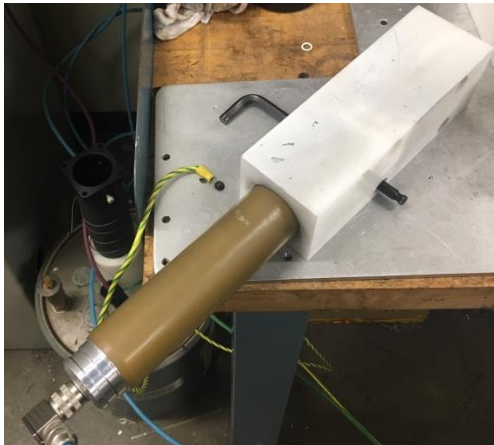
HV Controller

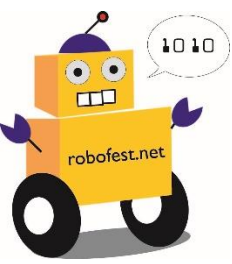


Arc



Cascade





Automotive paint robot video

- <https://youtu.be/fqMP6WX2o-g>

